

REMARKS

Claims 1-23 are pending and presented for examination in this application. Claims 8-14 are indicated in the office action (paragraph 10, page 6) to be allowable if rewritten in independent form. Claims 15-22 are allowed in the office action (paragraph 11, page 6).

As to the claim amendment to lines 11-12 of claim 1, see, e.g., Applicants' figures (especially grooves 24 and 34) and Applicants' specification at page 22, lines 14-20; page 25, lines 9-17.

As to new claim 23, see Applicants' specification at page 14, lines 5+.

The amendment above to claim 1 to change "opposing to" to "opposing" is not to change meaning, but to follow more typical English grammatical style. The amendment above to claim 15 to change "each the" to "each of the" is likewise.

Anticipation Rejection

At page 3, paragraph 6 of the Office Action, claims 1-6 have been rejected under 35 U.S.C. 102(b) as being anticipated by Strake (U.S. Patent 6,370,292). As to Applicant's claim 1, the Examiner cites Figures 1 and 2, especially the following item numbers which the Examiner corresponds to Applicants' claimed invention as follows:

- (3) optical waveguide
- (17) optical element
- (1) board
- (13) optical unit

Applicants traverse the rejection as follows.

Applicants' claim 1 recites: "An optical connection device for optically coupling at least one optical waveguide in which light propagates to at least one optical element disposed outside the optical waveguide." Applicants' inventive device comprises an optical waveguide, with "the optical waveguide provided in a board so that an optical axis thereof is parallel with a board

surface, a part of the optical waveguide being removed so as to form a groove along a plane angled at a predetermined angle to the optical axis of the optical waveguide” with “the optical element opposing the groove of the optical waveguide so that an optical axis of the optical element intersects with the optical axis of the optical waveguide”. Applicants’ claim 1.

Applicants’ inventive device also includes “an optical unit arranged at a position of intersection of the optical axes of the optical element and the waveguide for turning light by reflection from one of the optical axes of the waveguide and the optical element along the other of the optical axes.” (Applicants’ claim 1.) In Applicants’ claim 1, “the optical unit is fitted to the groove such that a surface of the optical unit is guided by a surface of the groove.”

Strake discloses an optoelectric multilayer printed circuit board. The optical coupling point that is shown in Strake’s Fig. 2 is between an optoelectronic component 17, a reflecting facet 15 and a waveguide”. (Strake, col. 4, lines 34-36 and Fig. 2.) Strake relies on “facet 15 which forms an angle of 45° with the longitudinal axis of waveguide core 3 and with the bore-hole axis.” (Strake, col. 4, lines 43-46.)

Applicants’ claim 1 recites “a part of the optical waveguide being removed so as to form a groove along a plane angled at a predetermined angle to the optical axis of the optical waveguide.” Strake does not teach or disclose such particular angling or shaping for a groove, or even any particular shape for the opening. Strake only generally discloses “an opening (bore hole)” (col. 4, line 41) which receives a pre-fabricated micropism. Strake glues the micropism in place in his openings (col. 4, lines 59-62) so that light is deflected from the waveguide plane by approximately 90° into the direction of the opening axis. After Strake glues the micropism into place, he fills the hole with transparent adhesive. (Col. 4, lines 65-67.) Alternately, Strake discloses that micropisms initially could be secured to their associated optoelectronic components by cementing, and then later the pre-cemented micropisms could be put into the openings followed by filing with transparent adhesive. (Col. 5, lines 8-10.) In neither case does Strake disclose or suggest an intended shape for the opening, nor, more specifically, does Strake teach that opening in the waveguide is a groove of the particular shape recited in Applicants’ claim 1. Thus, Strake fails to teach or disclose “a groove along a plane angled at a

predetermined angle to the optical axis of the optical waveguide” as in Applicants’ claim 1.

In summary, Strake teaches bore holes to which the optical element (i.e. micro prism 13) is connected (col. 4, lines 37-52), whereas the present invention recites “groove” which is not a bore hole. When such holes as taught in Strake are used to connect optical elements, it is necessary that individual holes are to be formed to connect individual optical guides. On the other hand, when a groove is formed so as to traverse plural optical wave guides as in the present invention, it is advantageous because the ports for connecting the optical elements for the optical elements can be formed more easily.

The present invention also is distinguished over Strake as follows. In Strake, the micro prism is fixed to the substrate by abutting a part of it (flange-like portion) with the upper surface of the layer 7. In addition, according to Figs. 2 and 3 of Strake, the outer diameter of the micro prism 13 is much smaller than the diameter of the bore hole. Referring to Strake, due to such an attachment structure, the position of the micro prism 13 with respect to the waveguide core 3 must be adjusted separately from insertion operation so that the optical axes of these two elements coincide with each other.

On the other hand, in the present invention, the groove (slit) 14 and the micro prism 13 are fitted so that the optical axes of the two elements coincide with each other by abutting the side surfaces of the micro prism 13 with the side walls of the slit 14. Therefore, in the present invention, no additional adjustment between the two elements is necessary and the unexpected misalignment due to impact or the like can be reliably prevented. Refractive-index matching resin is not necessary in the fitting structure of Applicants’ claimed invention.

For simplicity, Applicants do not comment on each dependent claim.

Wherefore, reconsideration and withdrawal of the anticipation rejection are respectfully requested.

Obviousness Rejections

At page 5, paragraph 9 of the Office Action, claim 7 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Strake. The Examiner admits (at page 6 of the office action)

that Strake does not disclose a plurality of the optical elements forming an optical element array. The Examiner's position is that it would have been obvious to reproduce the optical element to form an optical element array.

Applicants respectfully traverse this obviousness rejection.

As set forth above, Applicants' base claim 1 is more removed from Strake than the Examiner has admitted.

Moreover, Applicants' presently claimed invention of claims 1-7 provides unexpectedly superior results over Strake. Using Applicants' structure of claims 1-7, the overall structure is more secure and reliable because it is defined by a predetermined angle in the groove, compared to a structure of Strake in which the opening is not particularly specified and the angle of the microprism is attempted to be achieved as desired by relatively imprecise, inaccurate operations of gluing a microprism in place. Applicants' presently claimed invention advantageously avoids Strake's reliance on a large region of adhesive agent 14 (Strake Fig. 2). Optical coupling is relatively more difficult than electrical coupling, because electrical coupling only requires contact and optical coupling requires alignment. Applicants' presently claimed structure provides unexpectedly superior alignment and accuracy compared to Strake's less-securely aligned structure.

Also, as has been pointed out above, in Strake, the position of the micro prism 13 with respect to the waveguide core 3 must be adjusted separately from insertion operation so that the optical axes of these two elements coincide with each other. On the other hand, in Applicants' present invention, the groove (slit) 14 and the micro prism 13 are fitted so that the optical axes of the two elements coincide with each other by abutting the side surfaces of the micro prism 13 with the side walls of the slit 14. Therefore, in the present invention, no additional adjustment between the two elements is necessary and the unexpected misalignment due to impact or the like can be reliably prevented. Refractive-index matching resin is not necessary in the fitting structure of Applicants' claimed invention.

Wherefore, reconsideration and withdrawal of the obviousness rejection of claim 7 are respectfully requested.

In view of the foregoing, it is respectfully requested that the application be reconsidered, that claims 1-14 and 23 be allowed and that the allowance of claims 15-22 be repeated, and that the application be passed to issue.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephone or personal interview.

A provisional petition is hereby made for any extension of time necessary for the continued pendency during the life of this application. Please charge any fees for such provisional petition and any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 50-2041.

Respectfully submitted,

A handwritten signature in cursive script, reading "Mary E. Goulet".

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